

**Running Head:** Impulsivity and negative outcomes of alcohol use

Title Page

**Impulsivity and drinking motives predict problem behaviours relating to alcohol use in  
University students**

Katy A Jones\* <sup>a</sup>, Alexandra Chryssanthakis <sup>b</sup>, Madeleine J Groom <sup>a</sup>

Division of Psychiatry

Institute of Mental Health,

University of Nottingham Innovation Park

Triumph Road, Nottingham NG7 2TU

**\*Corresponding Author:**

Dr Katy Jones

Division of Psychiatry

Institute of Mental Health,

University of Nottingham Innovation Park

Triumph Road, Nottingham NG7 2TU, UK

E-mail: [Katy.Jones@Nottingham.ac.uk](mailto:Katy.Jones@Nottingham.ac.uk) Phone: 0115 82 84339

Word count: 5,352

**Abstract**

*Aims:* This study used a four-factor model of impulsivity to investigate inter-relationships between alcohol consumption, impulsivity, motives for drinking and the tendency to engage in alcohol-related problem behaviours.

*Methods:* 400 University students aged 18-25 completed an online survey consisting of the following measures: Urgency, Premeditation, Perseverance and Sensation Seeking Scale (UPPS) to measure impulsivity; Student Alcohol Questionnaire to assess drinking quantity, frequency and rates of problem behaviours; Drinking Motives Questionnaire to assess motives for drinking.

*Results:* The majority of the sample (94.5%) drank alcohol at least monthly. Path analysis revealed direct effects of urgency, sensation seeking and premeditation, as well as the quantity of alcohol consumed, on the tendency to engage in risky behaviours with negative consequences. The effect of urgency was mediated by drinking for coping motives and by a combined effect of drinking for social motives and consumption of wine or spirits. Conversely the effect of sensation seeking was mediated by the quantity of alcohol consumed, irrespective of drink type, and the effect of premeditation was mediated by the consumption of wine and spirits, in combination with enhancement motives.

*Conclusions:* Sensation seeking, urgency and lack of premeditation are related to different motives for drinking and also demonstrate dissociable relationships with the consumption of specific types of alcohol (beer, wine and spirits) and the tendency to engage in risky behaviours associated with alcohol consumption. Screening for high levels of urgency and for severe drinking consequences may be useful predictors of alcohol-related problems in UK University students aged 18 to 25 years.

**Key words:** Alcohol, Impulsivity, Urgency, University Students, Drinking Motives

## **1 Introduction**

At a general population level across the United Kingdom (UK), the magnitude of alcohol-related harm has significantly increased with serious problems such as excessive drunkenness in public, damage to public property, driving whilst intoxicated and physical violence becoming more common ((National Institute for Health and Care Excellence, 2011). A recent UK Government Alcohol Strategy Report presented to Parliament stated that, '50 years ago the UK had one of the lowest drinking levels in Europe, however it is now one of the few European countries whose consumption has increased over that period' (United Kingdom Department of Health, 2012, p. 3). As highlighted in the report, a key priority for 2014 is the identification of harmful drinkers (defined as those who engage in risky and hazardous behaviours that may cause damage to themselves or others when drunk (Babor, 2001) at a younger age with a particular emphasis on tackling the motives for drinking in order to prevent associated negative consequences (United Kingdom Department of Health, 2012).

Students represent a potentially unique hazardous and heavy drinking population wherein drinking with relative frequency and consuming extreme quantities of alcohol is a key component of the University experience (Adams, Kaiser, Lynam, Charnigo, & Milich, 2012; Hingson, Heeren, Zakocs, Winter, & Wechsler, 2003; Webb, Ashton, Kelly, & Kamali, 1996). Recent research has shown that alcohol-related harms (e.g. unintentional injury, driving or committing assault or sexual assault whilst intoxicated, engaging in unplanned or unprotected sexual activity) have become increasingly prevalent in a University population (Hingson, Heeren, Winter, & Wechsler, 2005; Hingson et al., 2003; Vik, Carrello, Tate, & Field, 2000). However, the majority of research measuring the range and type of alcohol-related harms in a University student population has been conducted in the United States of America (USA), a drinking culture that varies in subtle but important ways to the UK. For instance, young people can purchase alcohol legally at the age of 18 in the UK, but not until 21 in the USA. This may potentially lead to differences between USA and UK university students because in the UK drinking amongst university students is commonplace and generally tolerated whereas in the USA, illegal alcohol consumption by students may be penalised. If research in this field is to drive change in government policies around alcohol consumption in young people it is imperative that governments have data from their own countries to use as a basis for these policy changes.

Personality factors and motives for drinking may represent useful indices to gauge individual level of risk for harmful drinking during adolescence (Cyders, Flory, Rainer, & Smith, 2009) and in the future (see Ham & Hope, 2003). In particular, studies have found that the personality construct, impulsivity, the tendency to act without considering the consequences, is associated with greater and more risky alcohol consumption (Adams et al., 2012; Cyders et al., 2009; Magid, MacLean, & Colder, 2007) and with increased risk of future alcohol and substance abuse (Verdejo-Garcia, Bechara, Recknor, & Perez-Garcia, 2007). In addition, motives for drinking may mediate relationships between impulsivity and harmful drinking (Adams et al., 2012; Cooper, 1994; Ham & Hope, 2003; Magid et al., 2007). The Drinking Motives Questionnaire (DMQ) relates to a model of drinking motives in which four factors describe self-reported reasons for consuming alcohol. These comprise social motives (drinking in social settings for positive social reinforcement), conformity motives (drinking to avoid social censure or rejection), enhancement motives (drinking to enhance positive mood) and coping motives (drinking to alleviate negative emotions (Cooper, 1994).

Different aspects of impulsivity have been linked to specific drinking motives and alcohol use outcomes in students aged 18 to 25 years in the USA. Specifically, using the UPPS (urgency, premeditation, perseverance, sensation seeking) model of impulsivity (Whiteside & Lynam, 2003), Adams et al. (2012) reported relationships between problematic drinking and sensation seeking (a tendency to seek out and enjoy novel and exciting experiences) and (lack of) premeditation (the tendency to engage in behaviour without being able to anticipate the consequences before-hand), both of which were mediated by drinking for enhancement motives. Conversely, relationships between urgency (the tendency to engage in impulsive behaviour to alleviate a negative emotion) and problematic drinking were mediated by drinking for coping and enhancement motives. Lack of perseverance (an inability to maintain focus on a task, particularly when the task is long and/or boring) was not found to be an important predictor of problematic drinking. Using an alternative model of impulsivity comprising two factors (impulsivity and sensation seeking) Magid et al. (2007) reported that the relationship between sensation seeking and alcohol-related problem behaviours was mediated by drinking for enhancement motives and by the amount of alcohol consumed, whereas the impulsivity factor was directly related to problem behaviours but also mediated through drinking for coping motives.

Based on these findings, we developed a model of relationships between impulsivity, drinking motives, alcohol consumption and alcohol-related outcomes, which we tested in a sample of UK university students. Predicted paths between each variable are shown in Figure 1. We tested direct and indirect effects of three of the UPPS factors (urgency, sensation seeking, premeditation) on the tendency to engage in risky behaviours with negative consequences when drinking alcohol, measured with the Student Alcohol Questionnaire (SAQ; Engs & Hanson, 1994). We chose negative consequences as the dependent variable as this may be a more sensitive indicator of alcohol outcomes than drink quantity in a cohort who may be expected to consume large amounts with some regularity. We did not include the perseverance factor in the model because, firstly, the definition of this factor does not lend itself to clear predictions about alcohol-related harm; secondly, a previous study found that it was not a significant predictor of alcohol outcomes (Adams et al., 2012) and thirdly, in an initial analysis, we found that this factor did not predict negative consequences in our sample, either directly or through other mediating variables.

We predicted that alcohol consumption would mediate effects between specific UPPS factors and negative consequences. Specifically, based on previous evidence that sensation seeking leads to increased quantity of alcohol consumption but not directly to alcohol-related problem behaviours, whereas urgency shows the opposite profile (reviewed in Stautz & Cooper, 2013) we predicted a significant direct effect of urgency on negative consequences with no mediation through the quantity of alcohol consumed but an indirect effect of sensation seeking on negative consequences mediated by the quantity of alcohol consumed, with no direct effect on negative consequences (shown in Figure 1). To ensure this distinction between urgency and sensation seeking was supported we also modelled unpredicted indirect effects of urgency on negative consequences via alcohol quantity and the unpredicted direct effect of sensation seeking on negative consequences (these paths are not shown in Figure 1). In line with Adams et al. (2012) we predicted a direct effect of premeditation on negative consequences as well an indirect effect mediated by the quantity of alcohol consumed as this particular factor could be associated both with consuming more alcohol than intended and engaging in behaviours without thinking through the consequences.

We further predicted that drinking motives would mediate relationships between impulsivity and negative consequences. Specifically, the effect of urgency on negative consequences would be

partially mediated by drinking for coping motives and the paths from sensation seeking and premeditation to negative consequences would be mediated by drinking for enhancement motives, as reported by (Adams et al., 2012). Although neither Adams et al. (2012) nor Magid et al. (2007) found social motives to be a significant mediator, in the UK drinking at university is a typical part of peer interactions and so could prove to be an important mediator. We therefore included this factor in the model. Finally, and in line with the findings of Magid et al. (2007) we predicted that conformity motives would have a direct effect on negative consequences but would not mediate relationships between any impulsivity factor and negative consequences. To determine whether this focussed prediction was supported, we also modelled additional unpredicted indirect effects from each UPPS factor through conformity motives, and also through units consumed of each drink type (these paths are not shown in Figure 1).

We modelled consumption of different drink types (beer, wine, spirits) separately. It has been suggested that preferences for particular drinks are associated with different drinking patterns (Gronbaek, Jensen, Johansen, Sorensen, & Becker, 2004; Jensen et al., 2002). For instance, spirits raise blood alcohol more quickly than other drinks (faster feelings of intoxication) and may therefore be used by those who drink to get high or enhance an experience whereas wine drinkers are more moderate in their drinking habits (Gronbaek et al., 2004). However, the extent to which drink preference is related to impulsivity and drinking motives remains unexplored. Due to the relative lack of previous literature we gave each drink type equal emphasis in the model.

[Figure 1 here]

## **2 Methods**

### **2.1 Study design and procedure**

The survey and an online link were created using SurveyMonkey.com. The questionnaires were arranged and formatted to engage participants. Specifically, bright colours were chosen and each screen consisted of a maximum of 11 items. Contact information of mental health, drug and alcohol help organisations was provided following the relevant pages and at the end of the questionnaire. Average completion time was 30 minutes. Ethical approval for the study was granted by the University of Nottingham Faculty of Medicine and Health Sciences ethics committee.

## **2.2 Participants**

A total of 400 students, 148 males and 252 females, aged 18-25 (mean = 20, SD = 1.62) were recruited. Recruitment was via university of Nottingham e-mails, posters, announcements, the University of Nottingham intranet portal and Facebook. Participants were predominantly students at the University of Nottingham, UK, although a small number were based at other universities. Participants were asked to state their age, gender, and course of study, but remained anonymous. Participation and completion of the survey was voluntary.

## **2.3 Measures**

### **2.3.1 Alcohol Use**

Alcohol use was measured using the Student Alcohol Questionnaire-Revised (SAQ; Engs & Hanson, 1994). Participants were first asked how often they consume beer, wine and spirits. Responses were on a Likert Scale from 1-7 (1= everyday, 7=never). Those respondents who indicated that they consume beer, wine or spirits more than once a year (i.e. a rating of 1, 2, 3 or 4 on the Likert scale) were asked to indicate on the days that they consume each drink type, how much they drink, and asked to report any negative consequences relating to their alcohol consumption (see below). To ensure that participants did not have to calculate quantity in units while trying to complete the survey, they were asked to report beer quantity as number of pints, wine as number of standard glasses and spirits as number of shots. Quantities were then translated by the researchers into units using online national guidelines provided by the UK (National Institute for Health and Care Excellence, 2011).

### **2.3.2 Negative Consequences of Alcohol Use**

The SAQ includes a section which asks respondents to report the frequency of a range of different possible negative consequences of alcohol consumption. We reduced the number of items from 17 to 11 to reduce the length of the survey, avoid repetition and to increase the relevance to a UK sample. Four questions asked about driving while intoxicated, each with slightly different wording. Only one of these items ('have you driven a car when you've had too much to drink?') was retained in the questionnaire as it was the most culturally neutral example of these items. One item 'have you forced someone or been forced to have sex?' was removed for ethical reasons. Two further items, 'have you played a drinking game?' and 'have you received a lower grade because of your drinking?' were removed to reduce length of the survey as they were similar to other items. Items were scored on a 4

point scale: 1 = At least one within the past two months; 2 = At least once during the past year ; 3 = Has happened at least once in my life but not during the past year; 4 = Has not happened to me. All items were reversed so that high scores indicated greater frequency of negative consequences. Items were then summed to give a total score. Cronbach's alpha ( $\alpha$ ) for the 11 items used in the present study was .77.

### 2.3.3 Drinking Motives

Drinking motives (enhancement, social, conformity, coping) were measured using the Drinking Motivation Questionnaire (DMQ; Cooper, 1994), a 20-item self-report measure comprising four conceptually and empirically distinct factors reflecting different drinking motives: enhancement motives – drinking to experience a 'high'; social motives - drinking to celebrate with friends; conformity motives - drinking to fit in with a group or through peer pressure; coping motives - drinking to forget problems or worries. Scoring ranged from 1= never, 2=almost never, 3=some of the time, 4=almost half of the time, 5=most of the time and 6=almost always. Scores were summed for each of the 4 subscales. In published work, each factor has an internal consistency of .84 to .85, and items load uniquely on one of the four factors (Cooper, 1994). In the present study Cronbach's  $\alpha$  for the 4 factors ranged from .59 to .74.

### 2.3.4 Impulsivity

Impulsivity was measured using the UPPS Impulsive Behaviour Scale (UPPS; Whiteside & Lynam, 2003). The UPPS is a 45-item self-rated inventory based on a model of impulsivity which specifies the following 4 factors: urgency, lack of premeditation, lack of perseverance and sensation seeking. Urgency refers to a tendency to engage in impulsive behaviour to alleviate emotional distress. Lack of premeditation refers to acting on the spur of the moment with disregard for negative consequences. Lack of perseverance relates to the inability to sustain attention on difficult or boring tasks despite disinterest or fatigue and sensation seeking reflects a preference for exciting and novel experiences. Scores are given on a Likert scale ranging from 1 (agree strongly) to 4 (disagree strongly). Scores for each scale are calculated by computing the mean response across relevant items, after reversing the scoring of specific items. The four subscales have shown good internal consistencies in the original study (Whiteside & Lynam, 2003) with  $\alpha$  ranging from .82 to .91 and in the present study where  $\alpha$  ranged from .73 to .88.



## **2.4 Statistical Analysis**

The frequency of consumption of each drink type (beer, wine, spirits) was calculated in the whole sample ( $n=400$ ). Further analysis was restricted to those who had completed the negative consequences section of the SAQ, specifically, those who had consumed beer, wine or spirits at least once within the past year (corresponding to the cut-off in the survey which directed those who had consumed alcohol less frequently than this, to the end of the survey). A small proportion of participants ( $n=22$ ) did not meet this criterion and were excluded from further analysis.

To examine the factors leading to negative consequences of alcohol use in the sample of 378 regular drinkers of beer, wine or spirits, path analysis was performed using MPlus version 6.12 (Muthén & Muthén). The predicted model is shown in Figure 1 and described in the introduction section. The UPPS variables urgency, sensation seeking and premeditation were entered as exogenous, correlated variables. The coping, conformity, enhancement and social motives factors of the DMQ were entered as one set of dependent variables, in addition to drink quantity in units for each drink type (beer, wine, spirits). The frequency of self-reported negative consequences measured by the SAQ (log-transformed to correct skew) was the dependent variable. The significance of path coefficients, represented by standardised beta coefficients ( $\beta$ ) were tested against a threshold of  $p<.05$ . Five hundred bootstrap samples and 95% confidence intervals were used to evaluate the magnitude and statistical significance of the hypothesized direct and indirect effects.

The model was re-calculated with gender modelled as a grouping factor to determine whether any of the significant direct and indirect paths from impulsivity to negative consequences identified in the initial analysis were significant in only one gender.

## **3 Results**

The frequency and quantity of alcohol consumption in the whole sample is shown in Table 1. Figure 2 presents a breakdown of the frequency of each type of negative consequence from alcohol consumption as reported on the SAQ.

[Table 1 about here]

[Figure 2 about here]

### **3.1 Model analysis**

#### **3.1.1 Descriptive statistics**

Table 2 shows the means, standard deviations and Pearson's correlations between all variables in the model. Participants reported drinking higher quantities (in units) of beer than wine or spirits. Negative consequences on the SAQ correlated significantly with all other variables, with the categories 'had a hangover', 'gotten nauseated or vomited from drinking' and 'missed a class because of a hangover' occurring more frequently during the past 2 months than other categories (Figure 2). Males reported significantly higher scores on sensation seeking ( $t(1, 376) = 5.37, p < .001$ ) and consumption of greater levels of beer ( $t(1, 376) = 7.97, p < .001$ ) and spirits ( $t(1, 376) = 2.35, p < .05$ ) than females, whereas females scored higher on urgency than males ( $t(1, 376) = 2.80, p < .05$ ). Males also reported more negative consequences of alcohol consumption ( $t(1, 376) = 3.96, p < .001$ ). Age did not correlate significantly with any variable from the UPPS, DMQ or SAQ.

[Table 2 about here]

#### **3.1.2 Direct effects**

Figure 3 presents the path coefficients of significant direct effects between variables. As shown, there were direct effects of urgency, sensation seeking and premeditation on negative consequences. Sensation seeking and premeditation produced significant effects on the quantity of alcohol consumed; this was specific to wine for premeditation but common to all drink types for sensation seeking. Urgency however was not directly related to spirits, beer or wine units. Units consumed of each type of alcohol were significantly and positively related to negative consequences.

In addition, there were significant direct effects of urgency on coping, conformity motives and social motives, of sensation seeking on enhancement and social motives and of enhancement and social motives on alcohol units consumed.

[Figure 3 about here]

### 3.1.3 Indirect effects

To determine the degree to which relationships between the UPPS factors and negative consequences measured by the SAQ are mediated by drinking motives and the quantity of alcohol consumed, total and indirect effects of each personality trait on SAQ were measured. The total effect of urgency on negative consequences was significant ( $\beta = .28, p < .001, CI = .20, .35$ ). The direct effect of urgency ( $\beta = .18, p < .001, CI = .11, .26$ ) explained 11% of the variance and a further 8% was explained by the indirect pathway through coping motives ( $\beta = .07, p < .01, CI = .03, .1$ ). Indirect paths from urgency via beer, wine and spirits units were not statistically significant (all  $p > .1$ ). However indirect paths which combined social motives with spirits ( $\beta = .01, p < .05, CI = .002, .023$ ) or wine ( $\beta = .01, p < .05, CI = .002, .02$ ) were significant.

The total effect of sensation seeking on negative consequences was highly significant ( $\beta = .26, p < .001, CI = .19, .33$ ). Of this, only 1% of the variance in SAQ was explained by the direct pathway from sensation seeking ( $\beta = .09, p < .05, CI = .02, .16$ ). A further 18% was explained by the indirect pathway through spirits units ( $\beta = .04, p < .01, CI = .02, .07$ ), 18% was explained by a separate indirect pathway through wine units ( $\beta = .05, p < .01, CI = .02, .07$ ) and 15% by a separate indirect pathway via beer units ( $\beta = .04, p < .05, CI = .02, .08$ ).

Finally, the total effect of premeditation on negative consequences was highly significant ( $\beta = .20, p < .001, CI = .12, .28$ ). Within this, the direct path explained 10% of the variance ( $\beta = .09, p < .05, CI = .02, .16$ ) while the indirect path through wine units ( $\beta = .04, p < .05, CI = .01, .06$ ) explained an additional 17% of the variance. In addition, an independent indirect pathway combining spirits units and enhancement motives was significant ( $\beta = .01, p < .05, CI = .002, .02$ ), explaining 25% of the variance.

### 3.1.4 Gender-specific effects

The model was re-calculated with gender as a grouping factor. Only significant direct paths from the UPPS impulsivity traits to negative consequences and significant indirect paths mediating these relationships, as reported above, were examined to determine whether they were significant in only one gender.

The direct path from premeditation to negative consequences was significant only in males whereas the direct paths from urgency and sensation seeking to negative consequences were significant in

both genders. The indirect path from urgency to negative consequences through coping motives was significant in females ( $\beta = .06$ ,  $p < .05$ ,  $CI = .02, .11$ ) but reached only a trend level of significance in males ( $\beta = .07$ ,  $p = .06$ ,  $CI = .01, .12$ ). The indirect path from sensation seeking to negative consequences through wine units was significant in males ( $\beta = .07$ ,  $p < .05$ ,  $CI = .02, .11$ ) but did not quite reach significance in females ( $\beta = .04$ ,  $p = .07$ ,  $CI = .002, .07$ ). Finally, the indirect path from premeditation to negative consequences through wine units was significant only in females ( $\beta = .04$ ,  $p < .05$ ,  $CI = .01, .08$ ). All other mediating pathways were significant in both genders.

#### **4. Discussion**

This study set out to measure relationships between three different facets of impulsivity (urgency, lack of premeditation, and sensation seeking) and alcohol-related problems, and the extent to which these relationships were mediated by drinking motives (enhancement, social, conformity and coping motives) and the quantity of alcohol consumed (wine, beer and spirits). We found that in a UK sample of students, sensation seeking, premeditation and urgency worked through different pathways to increase either alcohol consumption and/or the likelihood of engaging in behaviours with negative consequences when drinking, indicating that relationships between different aspects of impulsivity and alcohol-related negative consequences cannot be understood in singular terms (Evenden, 1999). Specific findings are as followings.

Firstly, urgency (the tendency to do something impulsive to alter an emotional state) was directly related to negative consequences and, as predicted, showed an additional indirect pathway through drinking for coping motives. Additional unpredicted indirect pathways were found through the combination of social motives and spirits and wine consumption. Urgency was also related to drinking for conformity motives, although this relationship did not influence alcohol-related outcomes. Recent research has suggested that urgency may uniquely explain aspects of self-control for a variety of problematic behaviours such as alcohol consumption, deliberate self-harm and eating problems and is the only sub-scale of impulsivity that predicts such problems (Dir, Karyadi, & Cyders, 2013; Verdejo-Garcia et al., 2007). Our study provides further evidence that urgency is an important aspect of alcohol-related harm and should be conceptualised as an independent trait rather than being subsumed under a broader construct of 'impulsivity'. The mediating effect of drinking for coping motives is also consistent with Adams et al. (2012) who proposed two explanations for this effect.

Individuals high in urgency may use alcohol as a way of dealing with short-term distress, seeking temporary relief from negative emotions. Alternatively, these individuals may retrospectively misinterpret their behaviour as a positive coping style, even though they were not aware of this motive at the time and despite the fact that alcohol use is likely to set in motion a maladaptive coping style. The relationship identified in the present study between urgency, social motives and consumption of wine or spirits suggests these individuals may also drink to improve a social experience, resulting in negative consequences. Further research is needed to investigate these triggers more fully so that appropriate behavioural interventions can be developed. It may also be important to consider gender as the present study found that the indirect effect through coping motives was slightly stronger in females than males, although this was a weak effect and requires further replication.

Secondly, consistent with Magid et al. (2007), the effect of sensation seeking (the tendency to seek out and enjoy novel and exciting experiences) on negative consequences was mediated by the quantity consumed of each type of alcohol; these indirect effects explained a much greater proportion of the variance in negative consequences than the direct effect, and suggest that these individuals drink more as a way of potentiating an exciting or novel experience. This may then lead to risk-taking behaviours arising from the intoxicating effects of alcohol. Surprisingly, the predicted mediating effects of enhancement motives were not confirmed, contrary to previous studies (Adams et al., 2012; Magid et al., 2007). This may reflect the inclusion of both the social and enhancement motives factors in the model; the strong endorsement of the social motives factor by participants in this study may have obscured the role of enhancement motives given that both relate to drinking to increase the positive effects of alcohol. Further research is needed to assess the stability of relationships between sensation seeking and drinking for enhancement motives. Including gender in the model caused the indirect path through wine units to be significant only in males, although this remained at a trend level of significance in females, suggesting that there is only a small effect of gender here.

Thirdly, lack of premeditation (the tendency to engage in behaviour without being able to anticipate the consequences before-hand) produced a substantial direct effect on negative consequences. Once this direct effect has been accounted for, additional indirect effects either via wine consumption alone, or the combination of spirits consumption and drinking for enhancement

motives, were found. This is consistent with the findings of Adams et al. (2012) and suggests that individuals who score high on this aspect of impulsivity are prone to engage in risky behaviours with negative consequences, and that they may also be more sensitive to the disinhibiting effects of alcohol, particularly high volume alcohol drinks, such as wine and spirits. Individuals who score high on this trait or on sensation seeking may, according to Adams et al. (2012), benefit from a different style of intervention from those who score high on urgency, aimed at teaching them to focus on the negative consequences of drinking rather than the positive feelings they experience from alcohol. It is also possible that different strategies may be required for males and females as the present study found that the indirect path from premeditation through wine units was significant only in females whereas the direct path from premeditation to negative consequences was significant only in males. This requires replication but could indicate that males who score highly on the premeditation factor are more prone to engage in risky behaviours with negative consequences regardless of the amount of alcohol consumed, while females' scoring high on this factor drink excessively, which increases their propensity to risk-taking behaviours.

Drinking for conformity motives was directly related to the urgency factor but did not mediate relationships between any of the UPPS factors and alcohol-related outcomes. Furthermore, contrary to previous findings (Cooper, 1994; Magid et al., 2007), conformity motives were not related to the consumption of any drink type or to negative consequences. This lack of agreement between studies may reflect cultural and socio-demographic differences in the cohorts studied. Interestingly, unlike previous studies in the USA (Adams et al., 2012; Magid et al., 2007) the social motives factor mediated relationships between urgency and negative consequences via the quantity of spirits or wine consumption. This may reflect cultural trends in the UK in which drinking socially at university is a typical component of the student experience and those who score high on urgency may drink with the aim of improving a social experience.

The consumption of alcohol in our sample was consistent with UK Government concerns with students typically reporting consuming more than 5 to 8 units (depending on drink type) on one single occasion. This hints at a binge drinking style, although we were not able to calculate an accurate measure of binge drinking as the SAQ does not provide a way of determining whether the units consumed of each drink type were consumed in single or separate sessions. Complete abstinence

from any kind of alcohol beverage was extremely rare (<10%) fitting with previous reviews of the normality of regular alcohol consumption in UK student populations (Webb et al., 1996). Also consistent with Government concerns regarding harmful drinking in young people, negative consequences of alcohol use were commonly endorsed but varied in their severity, with 'frequent' or 'normal' consequences occurring in a large majority of students (such as vomiting, having a hangover or missing class) and a smaller subgroup of rarer but more severe consequences (alcohol related violence, law-breaking, property damage, driving when intoxicated). With regards to gender, similar to previous studies (Balodis, Potenza, & Olmstead, 2009; Waldeck & Miller, 1997) we found gender differences in impulsivity and drink choice, although we found only subtle differences in the direct and mediated effects of impulsivity and alcohol-related negative consequences between males and females. This is consistent with other findings (Balodis et al., 2009; Magid et al., 2007) and suggests that while there may be differences between male and female UK university students in specific personality traits and drink choices, these may have only a limited role in explaining variance negative consequences of alcohol use.

An important and unique aspect of this study was the division of alcohol consumption into different drink types. Previous work on this area is scant, although there is some evidence that higher volume alcohol such as spirits is associated with greater harm (Gronbaek et al., 2004). We found only limited evidence to support this in the present study; all types of alcohol were associated with an increased tendency to engage in behaviours with negative consequences and also mediated the relationship between sensation seeking and negative consequences to a similar extent as one another. However, spirits (in combination with enhancement motives) and wine mediated the relationship between premeditation and negative consequences whereas beer had no significant mediating effect, suggesting that individuals who score high on the premeditation factor may be more influenced by the disinhibiting effects of high than low volume alcohol drinks. In previous work wine has often been associated with moderation and low levels of harm (Gronbaek et al., 2004). The present findings could reflect the increased availability of cheap wine which may encourage greater consumption in UK university students.

Limitations for the current study include the generalizability of these data to non-University students outside the age range of 18 to 25. We acknowledge that university drinking potentially

represents a phase of 'developmentally limited alcoholism' (Zucker, 1987). Longitudinal data would be necessary to determine whether patterns observed here will translate into later adulthood.

Additionally, there is often a problem of underreporting of alcohol consumption, due to poor memory about recent drinking episodes (Stockwell et al., 2004). Future studies may consider using Time-Line Follow Back (Sobell & Sobell, 1992) methods to assess fluctuations in drink quantity and frequency across time. The AUDIT (Babor, 2001) may be a useful adjunct to the SAQ to help assess sub-threshold alcohol problems and provide more detail about dependence and binge drinking frequency. Finally, as with other large internet-based surveys, the information entered may not be accurate (all respondents may not be unique or all undergraduate students). However, participant recruitment was targeted at undergraduate students and the lack of financial reimbursement for participation makes it unlikely that respondents would complete the survey more than once.

In conclusion, impulsivity has been shown to be a key factor in the initiation and maintenance of alcohol use in young adolescents in the UK (Fennie et al., 2013) and now amongst individuals in late adolescence and early adulthood, which had previously only been shown in USA samples (Adams et al., 2012; Magid et al., 2007). Crucially, this study unpicks impulsivity beyond the basic impulsive versus sensation-seeking personality type, honing in on the specific aspects of impulsivity that are associated with consumption and problematic behaviours. We found a distinct effect of urgency on problematic consequences of drinking independently of the level of alcohol consumption, compared with sensation seeking and premeditation, which both moderated alcohol-related harm directly and as a consequence of increased consumption. There may be scope therefore for the identification of vulnerable individuals with specific interventions tailored to each sub-type, potentially proving more effective than global, untargeted advice.



## Acknowledgements

We gratefully acknowledge the assistance of Dr Boliang Guo in providing support with statistical analysis.

## References

- Adams, Z. W., Kaiser, A. J., Lynam, D. R., Charnigo, R. J., & Milich, R. (2012). Drinking motives as mediators of the impulsivity-substance use relation: Pathways for negative urgency, lack of premeditation, and sensation seeking. *Addictive Behaviors, 37*(7), 848-855. doi: 10.1016/j.addbeh.2012.03.016
- Balodis, I. M., Potenza, M. N., & Olmstead, M. C. (2009). Binge drinking in undergraduates: relationships with sex, drinking behaviors, impulsivity, and the perceived effects of alcohol. *Behavioural Pharmacology, 20*(5-6), 518-526. doi: 10.1097/FBP.0b013e328330c779
- Babor, T. F., Higgins-Biddle, J. C., Saunders, J. B., Monteriro, M. G. (2001). *AUDIT, The Alcohol Use Disorders Identification Test: Guidelines for Use in Primary Care*. World Health Organisation: Department of Mental Health and Substance Dependence.
- Cooper, M. L. (1994). Motivations for Alcohol Use Among Adolescents: Development and Validation of a Four-Factor Model. *Psychological Assessment, 6*(2), 117-128.
- Cyders, M. A., Flory, K., Rainer, S., & Smith, G. T. (2009). The role of personality dispositions to risky behavior in predicting first-year college drinking. *Addiction, 104*(2), 193-202. doi: 10.1111/j.1360-0443.2008.02434.x
- Dir, A. L., Karyadi, K., & Cyders, M. A. (2013). The uniqueness of negative urgency as a common risk factor for self-harm behaviors, alcohol consumption, and eating problems. *Addictive Behaviors, 38*(5), 2158-2162. doi: 10.1016/j.addbeh.2013.01.025
- Engs, R. C., & Hanson, D. J. (1994). THE STUDENT ALCOHOL QUESTIONNAIRE - AN UPDATED RELIABILITY OF THE DRINKING PATTERNS, PROBLEMS, KNOWLEDGE, AND ATTITUDE SUBSCALES. *Psychological Reports, 74*(1), 12-14.
- Evenden, J. (1999). Impulsivity: a discussion of clinical and experimental findings. *Journal of Psychopharmacology, 13*(2), 180-192.

- Fernie, G., Peeters, M., Gullo, M. J., Christiansen, P., Cole, J. C., Sumnall, H., & Field, M. (2013). Multiple behavioural impulsivity tasks predict prospective alcohol involvement in adolescents. *Addiction*. doi: 10.1111/add.12283
- Gronbaek, M., Jensen, M. K., Johansen, D., Sorensen, T. I. A., & Becker, U. (2004). Intake of beer, wine and spirits and risk of heavy drinking and alcoholic cirrhosis. *Biological Research*, 37(2), 195-200.
- Ham, L. S., & Hope, D. A. (2003). College students and problematic drinking: A review of the literature. *Clinical Psychology Review*, 23(5), 719-759. doi: 10.1016/s0272-7358(03)00071-0
- Hingson, R., Heeren, T., Winter, M., & Wechsler, H. (2005). Magnitude of alcohol-related mortality and morbidity among US college students ages 18-24: Changes from 1998 to 2001 *Annual Review of Public Health* (Vol. 26, pp. 259-279).
- Hingson, R., Heeren, T., Zakocs, R., Winter, M., & Wechsler, H. (2003). Age of first intoxication, heavy drinking, driving after drinking and risk of unintentional injury among US college students. *Journal of Studies on Alcohol*, 64(1), 23-31.
- Jensen, M. K., Andersen, A. T., Sorensen, T. I. A., Becker, U., Thorsen, T., & Gronbaek, M. (2002). Alcoholic beverage preference and risk of becoming a heavy drinker. *Epidemiology*, 13(2), 127-132. doi: 10.1097/00001648-200203000-00005
- Magid, V., MacLean, M. G., & Colder, C. R. (2007). Differentiating between sensation seeking and impulsivity through their mediated relations with alcohol use and problems. *Addictive Behaviors*, 32(10), 2046-2061. doi: 10.1016/j.addbeh.2007.01.015
- Muthén, L. K., & Muthén, B. O. (1998-2011). *Mplus User's Guide* (6th edition ). Los Angeles, CA: Muthén & Muthén.
- National Institute for Health and Care Excellence. (2011). *Alcohol: Introduction. A general introduction to Alcohol*. Manchester, United Kingdom: NICE Retrieved from <https://www.evidence.nhs.uk/topic/alcohol>.

- Sobell, L. C., & Sobell, M. B. (1992). Timeline Follow-Back – a technique for assessing self-reported alcohol consumption. In Litten, R.Z. & Allen, J.P. (Eds.) *Measuring Alcohol Consumption: Psychosocial and Biochemical Methods* (pp.71-42). Totowa, NJ: Humana Press Inc.
- Stautz, K., & Cooper, A. (2013). Impulsivity-related personality traits and adolescent alcohol use: A meta-analytic review. *Clinical Psychology Review, 33*(4), 574-592. doi: 10.1016/j.cpr.2013.03.003
- Stockwell, T., Donath, S., Cooper-Stanbury, M., Chikritzhs, T., Catalano, P., & Mateo, C. (2004). Under-reporting of alcohol consumption in household surveys: a comparison of quantity-frequency, graduated-frequency and recent recall. *Addiction, 99*(8), 1024-1033. doi: 10.1111/j.1360-0443.2004.00815.x
- United Kingdom Department of Health. (2012). *The Government's Alcohol Strategy Report*. London: HMSO.
- Verdejo-Garcia, A., Bechara, A., Recknor, E. C., & Perez-Garcia, M. (2007). Negative emotion-driven impulsivity predicts substance dependence problems. *Drug and Alcohol Dependence, 91*(2-3), 213-219. doi: 10.1016/j.drugalcdep.2007.05.025
- Vik, P. W., Carrello, P., Tate, S. R., & Field, C. (2000). Progression of consequences among heavy-drinking college students. *Psychology of Addictive Behaviors, 14*(2), 91-101. doi: 10.1037//0893-164x.14.2.91
- Waldeck, T. L., & Miller, L. S. (1997). Gender and impulsivity differences in licit substance use. *Journal of Substance Abuse, 9*, 269-275. doi: 10.1016/s0899-3289(97)90021-3
- Webb, E., Ashton, C. H., Kelly, P., & Kamali, F. (1996). Alcohol and drug use in UK university students. *Lancet, 348*(9032), 922-925. doi: 10.1016/s0140-6736(96)03410-1
- Whiteside, S. P., & Lynam, D. R. (2003). Understanding the role of impulsivity and externalizing psychopathology in alcohol abuse: Application of the UPPS impulsive behavior scale. *Experimental and Clinical Psychopharmacology, 11*(3), 210-217. doi: 10.1037/1064-1297.11.3.210

Zucker, R. A. (1987). The 4 alcoholisms – a developmental account of the etiologic process. *Nebraska Symposium on Motivation*, 34, 21-83.

**Table 1 Frequency of consumption of each type of alcohol in the whole sample**

	Everyday	At least weekly but not daily	At least monthly but not weekly	At least yearly but less than monthly	Once a year or less	Not during a year or less	Never
<b>Beer</b>	9 (2.3)	146 (36.5)	58 (14.5)	44 (11)	16 (4)	8 (2)	111 (28.3)
<b>Wine</b>	7 (1.8)	127 (31.8)	136 (34)	72 (18)	11 (2.8)	4 (1)	37 (9.3)
<b>Spirits</b>	4 (1)	202 (50.5)	111 (27.8)	44 (11)	6 (1.5)	5 (1.3)	28 (7)

The frequency of consumption of each type of alcohol is shown as measured using the Student Alcohol Questionnaire. Data shown are for the whole sample (n=400) in absolute frequencies with percentage shown in parentheses.

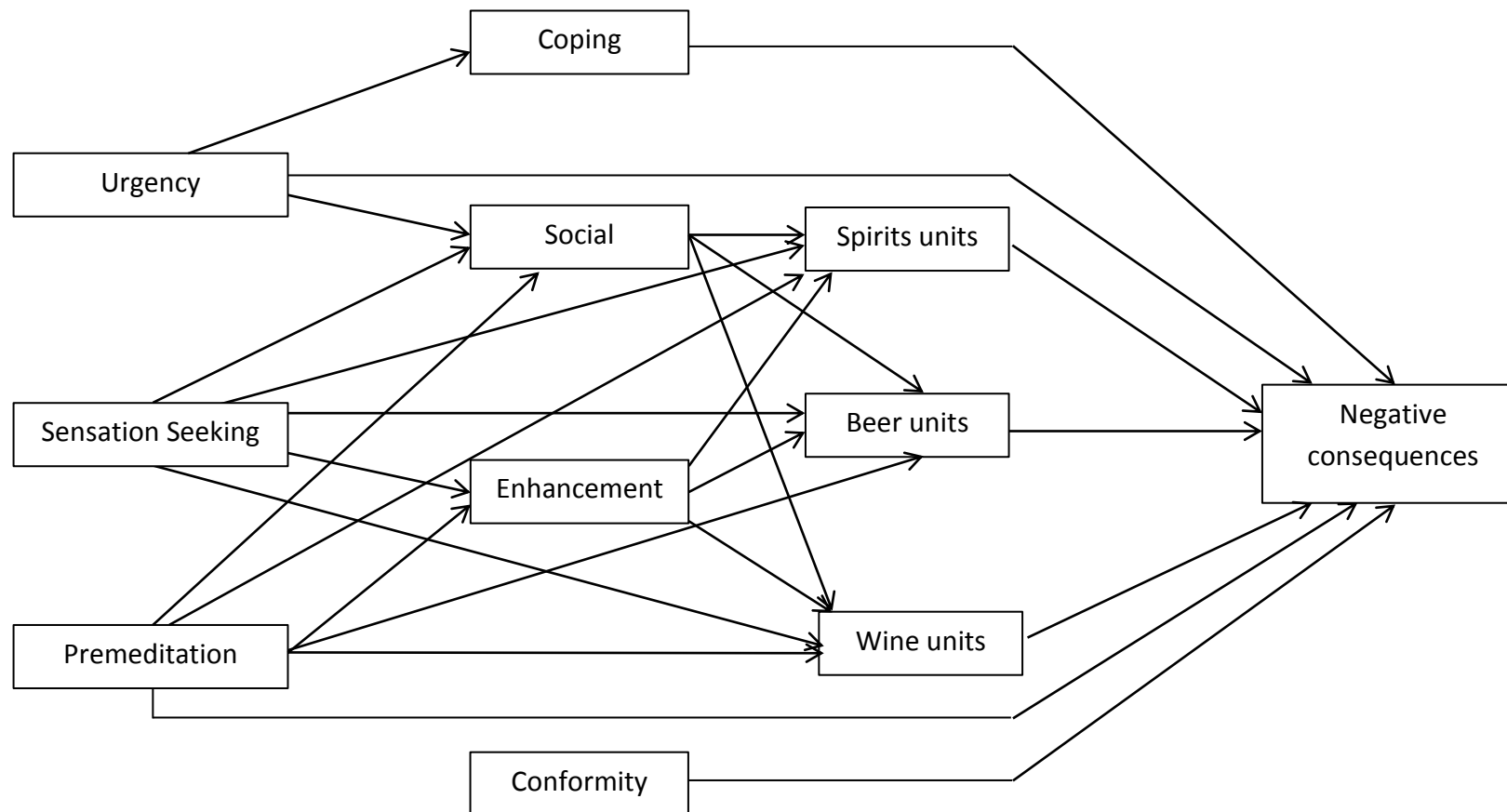
**Table 2: Means, standard deviations and correlation matrix of all variables included in path analysis**

	1	2	3	4	5	6	7	8	9	10	11
<b>1. Beer Units</b>	1										
<b>2. Wine Units</b>	.44***	1									
<b>3. Spirit Units</b>	.41***	.34***	1								
<b>4. Urgency</b>	-.04	.16**	.16**	1							
<b>5. Premeditation</b>	.14*	.26***	.19***	.24***	1						
<b>6. Sensation seeking</b>	.25***	.27***	.24***	.11*	.31***	1					
<b>7. Enhancement</b>	.27***	.31***	.34***	.15**	.24***	.20***	1				
<b>8. Coping</b>	.15*	.20***	.17**	.35***	.10	.08	.50***	1			
<b>9. Conformity</b>	.18**	.10	.02	.23***	-.01	-.02	.29***	.53***	1		
<b>10. Social</b>	.28***	.30***	.31***	.27***	.15**	.15**	.63***	.58***	.38***	1	
<b>11. Negative consequences<sup>1</sup></b>	.44***	.49***	.50***	.34***	.32***	.32***	.45***	.37***	.19***	.55***	1
<b>Mean</b>	8.16	5.09	5.64	2.29	2.95	2.05	11.33	7.12	6.15	17.38	2.92
<b>SD</b>	5.71	2.87	3.45	.56	.51	.56	3.52	2.85	2.97	4.33	.25

See Figure 2 caption and main text for explanation of each variable

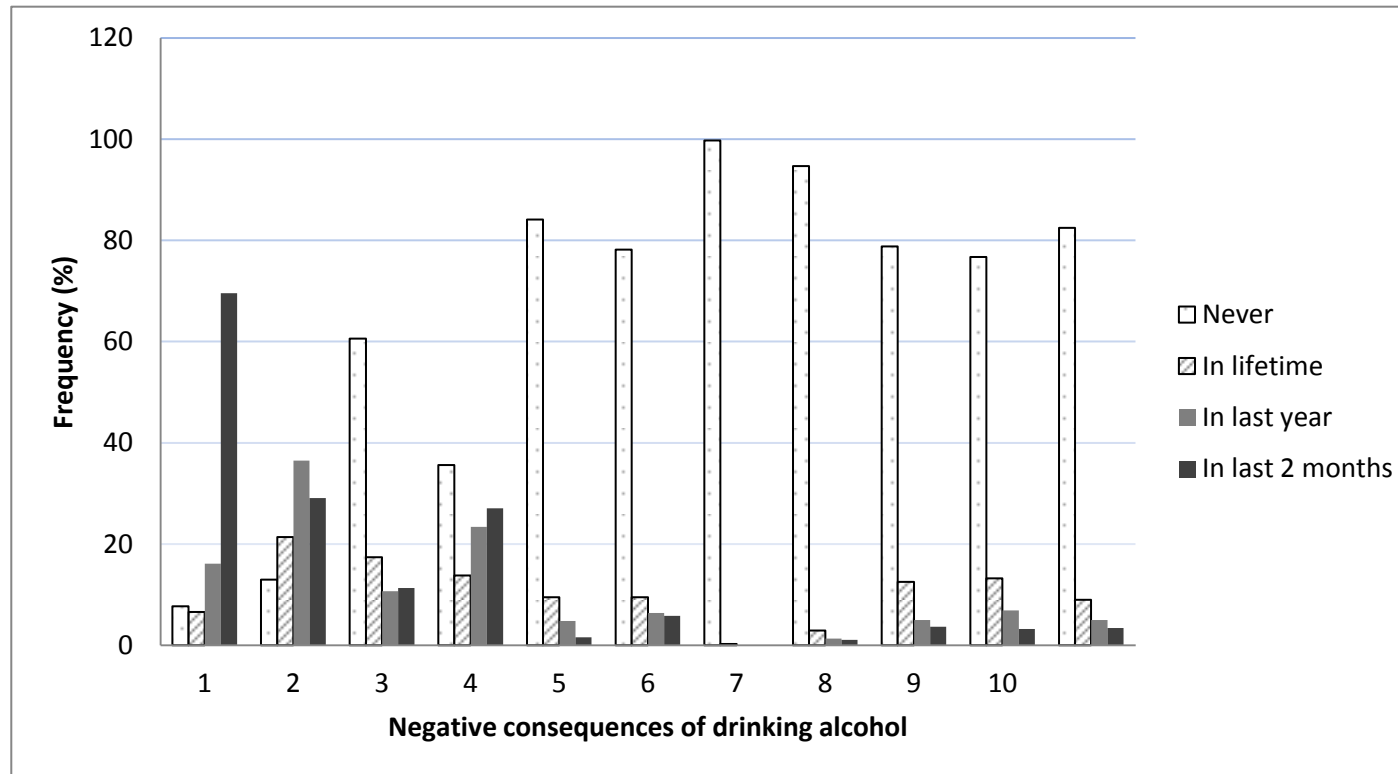
\*p<.05 \*\*p<.01 \*\*\*p<.001

<sup>1</sup> The correlation statistics, mean and SD were computed using the log-transformed score from the negative consequences section of the SAQ.

**Figure 1: Predicted model of relationships between impulsivity factors and negative consequences of alcohol consumption**

Urgency, Sensation Seeking and Premeditation are from the UPPS scale; Coping, Enhancement, Social and Conformity are from the Drinking Motives Questionnaire; the quantity of consumption of 3 types of alcohol in a typical single session was measured using the Student Alcohol Questionnaire (SAQ) and then converted to units; the frequency of negative consequences was measured using the SAQ. Please note, for clarity, only predicted relationships are shown. Other relationships that were not predicted but were tested to ensure reliability of the model are described in the introduction.



**Figure 2: Frequency of alcohol-related behaviours with negative consequences**

The x-axis shows the different alcohol-related behaviours with negative consequences measured by the Student Alcohol Questionnaire (SAQ). The bars represent the frequency of engaging in these behaviours as measured by the Likert Scale of the SAQ. The y-axis displays the frequency (in percentage) that each item was endorsed within the sample.

Numeric codes representing each category are: 1. Had a hangover; 2. Gotten nauseated and vomited from drinking; 3. Come to class after having several drinks; 4. Missed a class because of a hangover; 5. Driven a car when you've had too much to drink; 6. Been criticised by someone you were dating because of your drinking; 7. Lost a job because of drinking; 8. Gotten into trouble with university administration because of your behaviour resulting from drinking too much; 9. Gotten into a fight after drinking; 10. Damaged property, pulled a false alarm or other such behaviour after drinking; 11. Thought you might have a problem with your drinking.



Figure 3: The observed model showing significant direct relationships between variables included in path analysis

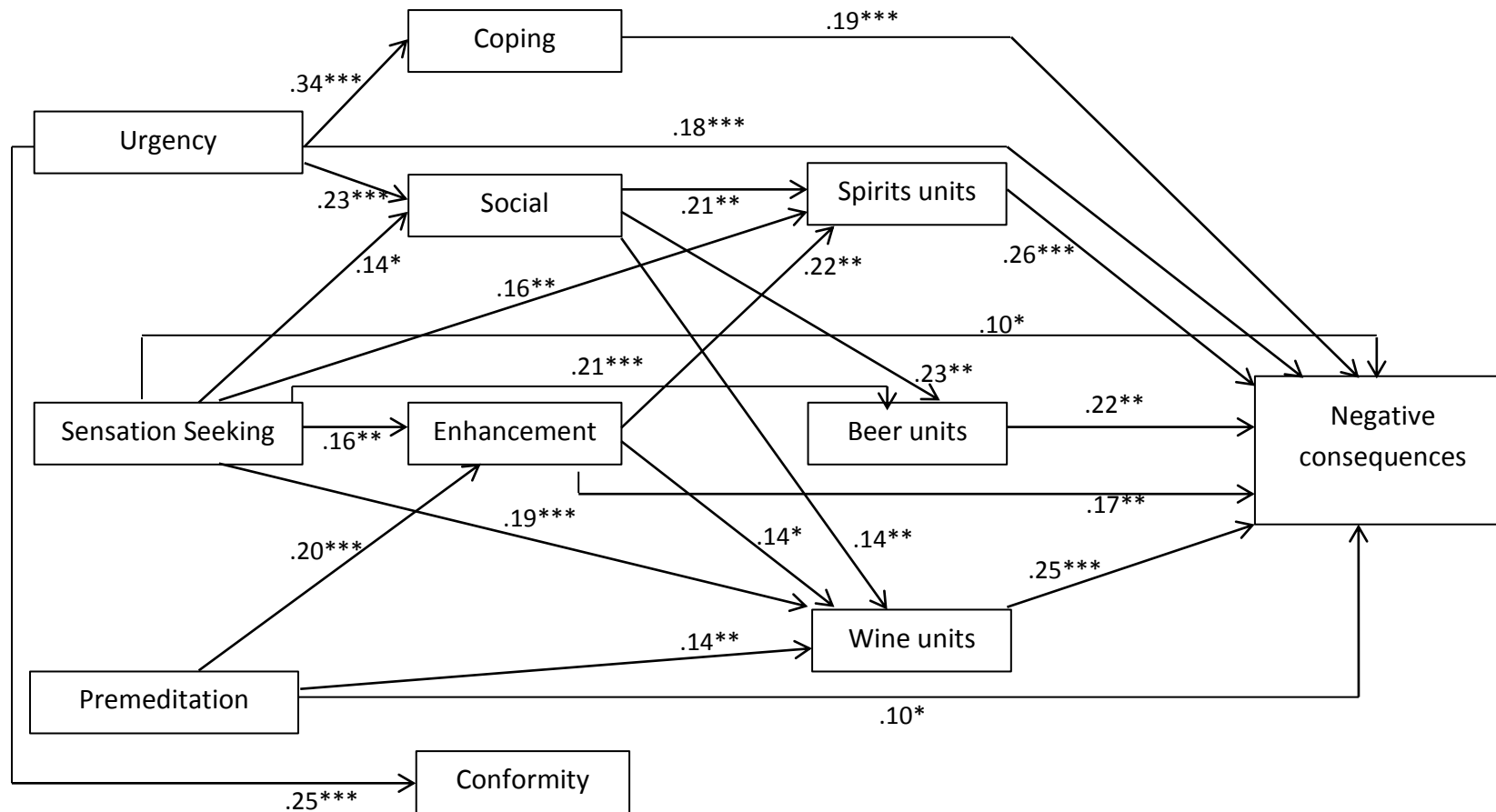


Figure 3: The observed model showing significant direct relationships between variables included in path analysis

#p<.1 \*p,>.05 \*\*p<.01 \*\*\*p<.001